Veterinary Parasitology 160 (2009) 168–170

Contents lists available at ScienceDirect

Veterinary Parasitology

journal homepage: www.elsevier.com/locate/vetpar

Short communication

Herbal dewormer fails to control gastrointestinal nematodes in goats

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ARTICLE INFO

Article history:
Received 15 August 2008
Received in revised form 8 October 2008
Accepted 15 October 2008

Keywords:
Goats
Gastrointestinal nematodes
Herbal dewormer

ABSTRACT

Gastrointestinal nematode (GIN) parasitism is the most important disease of small ruminants. Control is usually based on the use of chemical anthelmintics (dewormers); but these are prohibited from use in organic livestock, and the effectiveness of chemical anthelmintics in conventional operations is limited by high levels of anthelmintic resistance. Consequently, herbal dewormers are increasing in popularity as an alternative to chemical dewormers for GIN control. However, the effectiveness of herbal dewormers remains unproven. The objective of this study was to examine the effectiveness of a commercially available herbal dewormer to control GIN in goats. Lactating ($n = 16$) and young ($n = 8$) dairy goats grazed poor quality mixed grass pastures between March and July 2006 at the Heifer International Ranch in Perryville, AR. Goats were supplemented with grass hay and concentrate. Goats were untreated or administered herbal dewormer ($n = 12$/treatment) according to manufacturer recommendations. FAMACHA scores (1 = red or healthy; 5 = severely anemic) were determined and fecal samples collected for fecal egg count (FEC) determination every 14 days between Days 0 (day of first herbal treatment) and 112. FAMACHA scores in the herbal treated group were greater than in the untreated control group ($P < 0.005$), indicating a higher level of anemia. FEC were greater for herbal treated goats on Pasture A compared with B by Day 42, but similar among groups thereafter. FEC ($P < 0.03$) and FAMACHA scores ($P < 0.001$) were greater in lactating than in non-lactating goats. Herbal dewormer treatment yielded no measurable health benefits indicating that the herbal dewormer failed to control GIN in these goats.

Published by Elsevier B.V.

1. Introduction

Development of drug-resistant worm populations in the United States and throughout the world (Mortensen et al., 2003; Kaplan, 2004) and a desire to reduce the use of chemical anthelmintics, has led to the use of alternative products to control gastrointestinal nematodes (GIN). This trend is especially relevant to organic small ruminant production (Green and Kremen, 2003), and many organic producers have begun relying on commercially available herbal dewormers. Herbal dewormers often contain various mixtures of dried plants or plant products such as *Artemisia absinthium* (wormwood), *Allium sativum* (garlic), *Juglans nigra* (black walnut), *Cucurbita pepo* (field pumpkin), *Artemisia vulgaris* (mugwort), *Foeniculum vulgare* (fennel), *Hyssopus officinalis* (hyssop), and *Thymus vulgaris* (thyme). Many of these plants have demonstrated various levels of activity against nematodes and other parasites of humans and animals (Soffar and Mokhtar, 1991; Guarrera, 1999; Waller et al., 2001; El Shenawy et al., 2008). However, the effectiveness of commercial preparations marketed for use in small ruminants for GIN control has not been examined.

The objective of this study was to examine the effectiveness of a commercially available herbal dewormer to control GIN in goats.

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0304-4017/$ – see front matter. Published by Elsevier B.V.
doi:10.1016/j.vetpar.2008.10.080

2. Materials and methods

2.1. Animals and procedures

All experimental procedures were reviewed and accepted by the Institutional Animal Care and Use Committee at Heifer International in accordance with the NIH *Guide for the Care and Use of Laboratory Animals*.

Dairy goats of mixed age groups (16 mature goats, 8 kids) continuously grazed one of two poor quality mixed grass pastures between March and July 2006 at the Heifer International ranch in Perryville, AR. Older goats kidded in late February and were milked twice daily. Goats were supplemented with mixed grass hay as a group and a whole oat concentrate (12% CP; Hi-Grain Feed; AR Valley Farmers Association, Russellville, AR) on an individual basis (at least 500 g/day depending on level of milk production of does) and had access to trace mineral (Pro-phos 8 mineral; Land O'Lakes Purina Feed LLC, Shoreview, MN) and water. Goats were blocked by age and assigned randomly to untreated control or herbal dewormer (Molly's Herbals Complete Herbal Worm Formula Kit; Fias Co Farm; http://fiascofarm.com) groups (n = 12/treatment group). Treatment groups were split evenly between two pastures so that there were six herbal treated and six control goats on each of two pastures. Recommendations for this commercial dewormer involve the use of two different formulas. Formula 1 consists of *A. absinthium*, *A. sativum*, *F. vulgare*, *J. nigra*, and *Stevia rebaudiana* Bertoni, and recommendations are to administer a 19 g dose once daily for three consecutive days and repeated after 62 days (Day 0 = first day of herbal treatment). Formula 2 consists of *C. pepo*, *A. vulgaris*, *A. sativum*, *F. vulgare*, *H. officinalis*, *T. vulgaris*, and *S. rebaudiana* Bertoni and recommendations are to administer a 19 g dose once every seven days except during the week of Formula 1 administration. The two formulas of herbal dewormers were mixed with water and administered as an oral drench solution to individual animals. Herbal treatment was administered for 112 days.

Starting on Day 0 and then every 14 days for 112 days (with the exception of Day 56) FAMACHA scores (1 = red or healthy; 5 = severely anemic) were recorded by examining ocular mucous membranes (Kaplan et al., 2004), and fecal samples were collected per rectum. Fecal egg counts (FEC) were performed using the modified McMaster technique with a sensitivity of detection of 50 eggs/g (Whitlock, 1948). Individual goats were dewormed with moxidectin (Cydectin, 0.2 mg/kg) if FAMACHA score escalated to 4 or 5. A DrenchRite larval development assay (Microbial Screening Technologies, New South Wales, Australia; Gill et al., 1995) was performed, and results indicated that the nematodes infecting the goats were sensitive to moxidectin. The primary nematode present was *Haemonchus contortus*; this is a consistent finding during the spring and summer months in Arkansas (Burke and Miller, 2006).

2.2. Statistical analysis

Data were analyzed using the mixed models procedure of SAS (1996). The mathematical model used for FEC and FAMACHA scores included treatment, age, day, treatment by day, and a repeated statement for day of measurement. Contrasts were determined using the PDIFF option (all probability values for the hypothesis) in SAS when probability was less than 0.05%. FEC data were log transformed: ln(FEC + 1). Statistical inferences were made on transformed data and untransformed least squares (LS) means were presented.

3. Results and discussion

FAMACHA scores were greater ($2.6 > 2.1 \pm 0.10$; $P < 0.005$; Fig. 1B) for the herbal treated goats and increased after March (Day 14) for all groups, but no treatment by day interaction was detected. FEC were greater for herbal treated goats on Pasture A compared with B by Day 42, but similar among groups thereafter (treatment by pasture by day, $P < 0.001$; Fig. 1A). FAMACHA scores were similar between the two pastures. These data demonstrate that the herbal dewormer failed to provide any measurable benefit to the treated goats.

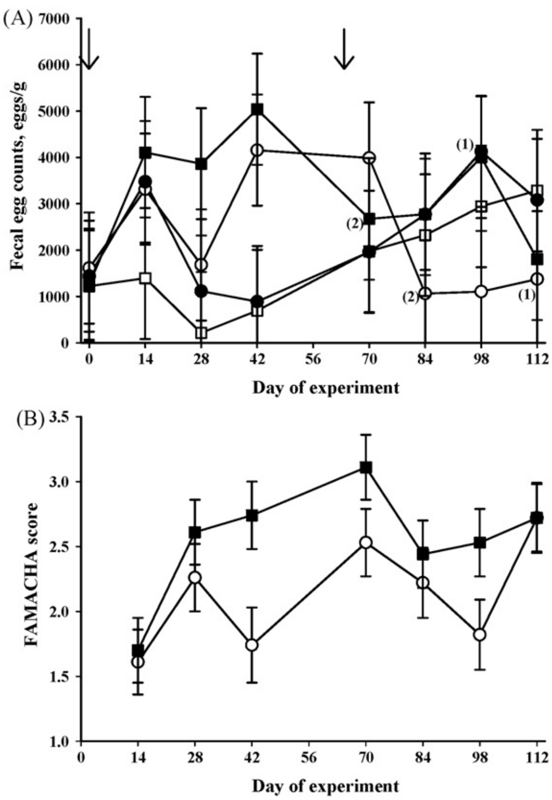

Fig. 1. (A) Effect of untreated (white symbols) or herbal dewormer treatment (black symbols; n = 12/treatment) on fecal egg counts (FEC) in dairy goats grazing summer pastures (Pasture A, circles; Pasture B, squares; n = 12/pasture) from days 0 through 112 after first administration of herbal dewormer. Arrow indicates first day goats were administered first formula within each recommended treatment period. A number to the left of symbol indicates number of animals that were dewormed with moxidectin on that day, which were removed from data the following week. Least squares means and SE are presented and statistical analysis of FEC was performed on log transformed values. (B) Effect of control (white circles) or herbal treatment (black squares) on FAMACHA scores with data from Pastures A and B pooled.

A lack of effect of a commercial herbal dewormer is in agreement with Luginbuhl et al. (2006) who administered an herbal mixture that included *A. sativum* and *A. absinthium* (Farmstead Health Supply, Hillsborough, NC). It is possible that the dose recommended by the manufacturer for the product tested in our study may not be high enough to produce anthelmintic properties. However, higher doses of *A. absinthium* could be toxic or cause abortion in pregnant animals due to the presence of santonin in this plant (Waller et al., 2001).

FEC were greater in older than younger goats ($2879 > 1917 \pm 310$ eggs/g; $P < 0.03$), indicating that the physiologic stress and protein demands of lactation caused a greater susceptibility to GIN. Similarly, FAMACHA scores were greater for the older does ($2.7 > 1.9 \pm 0.10$; $P < 0.001$), which correlates with a higher level of anemia (Kaplan et al., 2004). The metabolic challenge in a lactating dairy goat makes it difficult to meet nutritional requirements (NRC, 2007). Also, poor pastures typical of summer pastures in the absence of rain in the southeastern US could have exacerbated GIN problems in these does. An increase in nutritional plane of lactating small ruminants can decrease susceptibility to GIN (Coop and Holmes, 1996).

The herbal dewormer used in this study failed to control GIN in these goats. There continues to be an urgent need for alternatives to chemical dewormers. Conventional producers are increasingly faced with trying to control multiple-drug resistant worms, and organic producers in the U.S. cannot use chemical dewormers and maintain the organic premiums on their animals. Other novel methods of control acceptable for organic production include grazing condensed tannin-rich forages such as sericea lespedeza (Niezen et al., 1995, Min and Hart, 2003), rotational grazing (Barger, 1997; Rocha et al., 2008) and inclusion of browse in the diet for goats. Clearly more research on alternatives to chemical anthelmintics for nematode parasite control, and optimal approaches for integrating these methods is urgently needed.

Acknowledgements

This research was supported by USDA Sustainable Agriculture Research and Education (SARE) program (Project No. OS07-039). A special thanks to the volunteers at Heifer International that participated in this project. The Southern Consortium for Small Ruminant Parasite Control (www.scsrpc.org) played a role in discussion of this project.

Mention of trade names or commercial products in this manuscript is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.

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